HARVARD | BUSINESS | SCHOOL

State and Local Government Employment in the COVID-19 Crisis

Daniel Green
Erik Loualiche

Working Paper 21-023

State and Local Government Employment in the COVID-19 Crisis

Daniel Green
Harvard Business School

Erik Loualiche
University of Minnesota

Working Paper 21-023

Copyright © 2020 by Daniel Green and Erik Loualiche.

Working papers are in draft form. This working paper is distributed for purposes of comment and discussion only. It may not be reproduced without permission of the copyright holder. Copies of working papers are available from the author.

Funding for this research was provided in part by Harvard Business School.

State and Local Government Employment in the COVID-19 Crisis

Daniel Green and Erik Loualiche[†]

August 12, 2020

Abstract

Local governments are facing large losses in revenues and increased expenditures because of the COVID-19 crisis. We document a causal relationship between fiscal pressures induced by COVID-19 and the layoffs of state and local government workers. States that depend more on sales tax as a source of revenue laid off significantly more workers than other states. The CARES Act's provision of $150 billion in aid to state and local governments reduced the fiscal pressures they faced. Exploiting a kink in the formula for allocation of funding across states, we estimate a state and local government employment multiplier for federal aid—each dollar of federal aid was used by states to support 31 cents of payrolls. State rainy day fund balances limit the sensitivity of employment to both revenue shocks, revealing that balanced budget requirements for state and local governments increase the procyclicality of public service provision.

[†]Green: Harvard Business School, email: dgreen@hbs.edu; Loualiche: Carlson School of Management, University of Minnesota, email: eloualic@umn.edu. We thank Sid Beaumaster and Jin Yao for outstanding research assistance. Thanks to Jonathan Parker, John Green, and seminar participants at the HBS Finance Lunch for helpful feedback.

1 Introduction

The onset of the COVID-19 pandemic created unprecedented challenges for governments across the globe. Virtually overnight they were forced to organize, implement, and finance responses to both public health and economic crises. In the United States, state and local governments account for a large share of overall government service provision, particularly so for those most essential in a the pandemic. Unemployment benefits, education, public safety, and health services are largely administered at the state and local levels. While the federal government has been able to respond with dramatically increased spending, local governments are subject to balanced budget requirements. They cannot significantly increase spending without corresponding increases in revenues. But the pandemic-induced demand for government services has coincided with a substantial decline in the tax revenues collected by state and local governments. Thus, a centrally important question for informing policy response to the pandemic is how fiscal pressures on state and local governments affect their ability to respond to the crisis, and continue to function in the potentially prolonged economic downturn.

We provide early evidence on this question by studying the dimension of local government activity on which data is most expeditiously available–public sector employment. April 2020 saw record declines in national employment, with the Bureau of Labor Statistics Current Employment Survey (CES) estimating a month-over-month loss of more than twenty million jobs. Surprisingly, nearly one million of these lost jobs were in the public sector. By May, 1.5 million public employees had been laid off. There were essentially no job losses among federal workers, all public sector job losses stemmed from state and local governments.

We show that the capacity of local governments to withstand fiscal pressures induced by the pandemic negatively predicts municipal layoffs. Fiscal capacity of all state and local governments is constrained by balanced budget requirements, which prevent borrowing to finance non-capital expenditures such as payrolls. Subject to these requirements, states in which revenues are more exposed to the pandemic-induced economic contraction face greater fiscal pressure in the short term.

Lost sales tax revenues, deferred tax payments, and lowered projections for income and property taxes have strained the finances of states, municipalities, and other local governments during the COVID-19 pandemic. These pressures are significant. As of July 1, 2020, twenty-six states were predicting fiscal year 2020 revenue shortfalls of more than ten percent. Budget analysts in Colorado, Wyoming, Hawaii, and New Mexico forecast funding gaps of over twenty percent of pre-pandemic budgets.[1]

[1]These figures are based on hand-collected budget reports released by forty states from April to June 2020.

The main contribution of this paper is to document and quantify the relationship between fiscal pressures on state and local governments and the contraction of state and local government employment in the first months of the pandemic. We measure governments' revenue sensitivity to the pandemic in two ways. First, lockdowns and stay at home orders lead to a sharp contraction in sales tax revenue. State and local governments vary in the composition of their tax base—Florida collects no income taxes and is thus heavily dependent on general merchandise and tourism sales taxes, while Delaware has no general sales tax. We construct a measure of state and local governments' sales tax dependence and find states with larger sales tax dependence saw a sharply larger contraction of public employment in April 2020. State and local governments deriving ten percentage points more of their revenues from sales taxes saw 2.6 percentage points higher unemployment among their government workers. A back-of-the-envelope aggregation exercise suggests that sales tax exposure alone can explain over 660,000 of the state and local government jobs lost in April, about two-thirds of the total observed declines.

We also study the effect of federal grants to state governments that were part of the 2020 CARES Act, the two trillion dollar stimulus package enacted by the federal government on March 27, 2020. A total of $150 billion of aid, through the Coronavirus Relief Fund (CRF), was awarded to states in proportion to their population, except for the smallest 21 states, which received $1.25bn of support regardless of their population. For the smallest states funding was equivalent to as much as 15 percent of annual state and local government revenues, and less than five percent of revenues for larger states which received funding proportional to their population. We exploit this kink in the CRF award schedule to instrument for the size of the federal aid received as a fraction of government revenues. States that received more funding made smaller cuts to public employment. Expressed as a fiscal multiplier, each dollar of CRF funding supported roughly 31 cents of state and local government payrolls.

Further, states with smaller rainy-day funds had higher employment elasticities to both sales tax dependence and the size of the state's CRF aid. The magnitude of the elasticity of public employment to sales tax dependence is highest for states with small rainy-day fund balances. States with rainy day funds as a percent of annual expenditure in the lowest tercile have employment declines that are nearly three times as sensitive to sales tax dependence and federal funding than states in the top tercile of reserves.

Together, these findings suggest that state and local governments adjusted employment in a manner consistent with a binding budget constraint. The fact that public employment declined in response to short term deficit pressures alone suggests either that local governments faced binding intertemporal resource constraints or that they expected permanent fiscal imbalances. However, the fact that states with the lowest funding reserves responded

most aggressively to these fiscal pressures suggests balanced budget rules play a significant role in shaping local government policies.

We are also able to shed some light on which government services were impacted by fiscal pressures of the pandemic. In addition to studying the relationship between fiscal measures and broad public employment, we also look specifically at layoffs among public employees in healthcare occupations. Sales tax dependence is not related to layoffs in healthcare occupations, suggesting that governments prioritized these jobs. However, we do find that increased federal aid is associated with fewer layoffs among healthcare workers. This is consistent with the fact that state and local funding from the CARES Act was supposed to be used only for unplanned expenses related to the pandemic, and also reveals that the minimum amount of funding received was not enough to prevent all healthcare layoffs.

Our findings have important implications for the role of fiscal policy and debt policy in government. As documented by Baicker et al. (2012), state and local governments are responsible for a growing share of public service provision in the United States. The fact that these governments cannot borrow to smooth revenue and expenditure shocks means that in the absence of sizable federal intervention or aggressive tax increases, a large amount of government service provision is necessarily procyclical. If state and local governments could borrow against future tax revenues they would likely not be forced to reduce service provision precisely when it is in greatest demand.

Literature Review. This paper investigates the real effects of state and local governments' budget and financing rules in the context of the COVID-19 pandemic. In early work on the topic, Poterba (1994, 1995a,b) shows that balanced budget rules impact states' fiscal response to deficit shocks–those with more stringent balance requirements react with greater tax increases and spending cuts. Subsequent work by Fatás and Mihov (2006) and Hou and Smith (2010) has re-emphasized the role of balanced budget requirements for fiscal policy. Alt and Lowry (1994) show how other institutional constraints, specifically politically divided state governments, make government policy less responsive to revenue shocks. We contribute to the literature examining the impact of financing constraints of local governments on their payroll, as public employment is a growing share of total expenditure of local governments.

The effect of a change in tax revenue on employment is closest to the work on local fiscal multipliers. Shoag et al. (2017) highlights the sales tax dependence of municipal governments and the fiscal implications of shocks to sales tax revenues. Clemens and Miran (2012) use the methodology of Poterba (1994) to evaluate the effect of a Ricardian multiplier. Chodorow-Reich (2019) gives a thorough review of the literature, which focused on the 2008 crisis and the American Recovery and Reinvestment Act (e.g. Chodorow-Reich et al. (2012);

Wilson (2012); Shoag (2013); Suárez Serrato and Wingender (2016)).

Last we add to a rapidly growing body of literature exploring the consequences of the coronavirus crisis. Cajner et al. (2020) and Kahn et al. (2020) both use private-sector data to trace out the real-time impact on private labor markets of the coronavirus crisis and the shutdowns. We find similar magnitudes of decline in private employment using the Current Population Survey (CPS). Other studies have used the CPS to draw out a more complete picture of the labor market: Fairlie et al. (2020) analyzes its impact on minority employment.

We also contribute to the emerging literature analyzing government policy response to the pandemic and its relation to financial institutions and constraints. Granja et al. (2020) and Erel and Liebersohn (2020) study the allocation of funding under the Paycheck Protection Program.

2 Data and Summary Statistics

2.1 Data

We use data from the monthly files of the Current Population survey (CPS, see Flood et al. (2020)), which is the main source for the survey measure of unemployment from the Bureau of Labor Statistics. The CPS is a repeated cross-section of more than 130,000 people representative of the U.S. population as a whole.

We focus on the CPS monthly surveys from January to June of 2020. The March CPS data surveys households until March 14th, before most of the states began implementing social distancing measures or shutdown policies. Therefore we focus our attention on the April CPS survey, collected during the week of the 12th to the 18th of April, which gives a more complete picture of the impact on employment of the pandemic in the U.S.[2] We also examine employment outcomes during the initial reopening of states in May and June. Additional details about the employment data are described in the Online Data Appendix.

Data to gauge the fiscal capacity of state and local governments to respond to the pandemic comes from several sources. First, we use the Annaul Survey of State and Local Government Finances (ASSLGF) from the Census of Governments. This survey and associated reports provide annual estimates of state and local government revenues sources, and expenditures, and debt at an annual frequency. This data is produced by the United States Census Bureau, and the most recently available data is from 2017. The Online Data Appendix provides more information about this data and how we use it to construct the variables used in our analysis. We also employ data from the National Association of State

[2]The CPS survey asks respondents about their employment status in the week containing the 12th day of the month.

Budget Officers (NASBO) on the size of state rainy day funds. Finally, we use data from the United States Treasury on the size of the Coronavirus Relief Fund aid allocated to each state.

Data on severity of the pandemic comes from the Covid Tracking Project and from Raifman et al. (2020). We define *COVID Infection Rate* and *COVID Death Rate* as the total number of COVID cases and deaths reported in a state per 100,000 of population. For regressions measuring employment outcomes in April 2020 this data is through end of March 2020. For regressions measuring employment outcomes in May the case and death data is through the end of April, and through the end of May for regressions measuring employment outcomes in June.

2.2 State and Local Governments in the United States

All of the U.S. States are constrained by balanced budget requirements.[3] The large municipal debt market generally funds capital expenditures, it is only *operating budgets* that are required to balance each budget cycle. The stringency of constitutional balanced budget provisions varies somewhat from state to state (see Hou and Smith (2010)). However, statutes, strong budgetary norms, and limits on notional general obligation debt are broadly understood to effectively prevent state and local governments from running large and persistent operating deficits (see National Conference of State Legislatures (2010)).

Taxation and public service provisions in the United States occurs at three broad levels of government—federal, state, and local. State governments organize public activity not specifically delegated to the federal government in the Constitution. Among these are the right to raise taxes, regulation of property ownership, and the provision of education, health and welfare services, public safety, and maintain state roads. State governments in turn delegate some authorities to local levels of government. Local governments are comprised of counties, cities and townships, other municipalities, and special districts. School districts for example are often technically not part of municipalities and comprise their own government with revenue collection authority. The presence and relative importance of different types of local governments varies regionally.

In 2017 Federal outlays totaled $4.1 trillion. Of this, over $700 billion was allocated to state and local governments. In terms of direct spending, state and local governments together are roughly the same size as the federal government. State and local governments direct expenditures in 2017 were $1.76 trillion and $1.90 trillion, respectively. Full time equivalent employment at the federal level was 2.1 million, at state level, 4.4 million and at local level, 12.2 million workers. The share of overall public service provision provided by

[3] Vermont is the exception to this rule; however its legislature consistently adopts a balanced budget by tradition.

state and local governments has been increasing over time. From 1968 to 2017 state and local spending grew from 8% to 19% of GDP and from 30% to 52% of total government spending (Baicker et al., 2012).

On average across states, state and local governments spend $31.7 billion on salaries and wages, amounting to 27% of their total expenditures. This translates into 326,000 employees on average across states, amounting to 11% of total employment. Note that the share of salaries and wages in local government is 37% on average which is significantly higher than for state governments at 13%, due to secondary education.

We argue in Section 3 how the constraints on local governments budgets during the COVID-19 crisis led states to cut the size of their workforce. The BLS reports that there were 20.6 million people who lost their job between February and April of 2020 in the private sector, and close to a million in the state and local government sector, 4.5% of the total job losses.

Taxation constitutes the main source of revenue for state and local governments, though there is variation in the composition of these revenues. We report summary statistics of tax revenues across state and local governments, and the volatility of tax revenues in Appendix Table A1. State governments rely on sales and individual income taxes, which account for almost 70% of revenues, while local governments, counties and municipalities, lean on property taxes. Even between states the composition of taxation is not uniform, as some states do not impose an income tax (e.g. Texas, Florida), or a sales tax (e.g. Delaware, Alaska). Tax revenues are volatile and procyclical due to the cyclicality of the tax base. We find that there is ample variation across states and local governments in the time-series volatility of tax revenues. The average time-series volatility across states is 9.5% for the sales tax, and 17% for individual income tax —the average volatility of total tax revenue is 9% (see Appendix Table A1).

The most dramatic short-run shock to revenue stemmed from sales taxes. For example as sales taxes represent more than 60% of total revenues for the state of Florida, sales tax receipts in April 2020 declined by $700mn (a 21% year-on-year drop).[4] We show in Section 3 how states with different reliance on sales taxes have responded differently to the COVID-19 crisis.

[4]The state of New York also experienced the same 21% year-on-year drop in sales tax receipts, though only 18% of its revenues are from sales taxes. Sources for monthly tax receipts from the Department of Revenue for the State of Florida (https://floridarevenue.com/taxes/Pages/distributions.aspx, last accessed on June 5 2020) and from the Office of the New York State Comptroller (https://www.osc.state.ny.us/finance/cash-basis last accessed on June 5 2020).

3 Empirics

We now examine the response of state and local government spending to fiscal pressures and the extent to which these dynamics are affected by the balanced budget requirements. We focus on the short run response of government employment to the COVID-19 crisis in the Spring of 2020. In the Appendix we consider the external validity in our claims and expand our study to the period covering 1992 to 2018.

To prevent further spread of the COVID-19, state and local officials enacted shutdown policies across the U.S. with varying degrees of stringency (see Figure A1). These policies brought the economy to a halt leading to an immediate decline in state and local government revenues and uncertainty around when they would recover. We test whether this sudden income shortfall, coupled with the institutional constraints of balanced budget requirements, affected local government service provision in the short run.

The ideal experiment to test this relationship involves estimating the cross-sectional relation between government service provision and the extent to which their revenue is impacted by the COVID-19 crisis. Measuring each of these variables presents challenges. Comprehensive data on government expenditure and revenue at the state and local level is only available with a substantial lag, and there are many reasons other than the COVID-19 pandemic that expenditures and revenues covary.

To measure public service provision we use data on public sector employment from the CPS monthly survey, which becomes available several weeks after the survey is conducted. To overcome the endogeneity issues, we introduce two instruments for revenue that attempt to isolate plausibly exogenous variation in fiscal pressure attributable to the pandemic.

3.1 Sales Tax Dependence

First, we capture the variation in short term revenue declines using an ex-ante measure of the share of government revenues derived from sales taxes. Declines in income tax receipts due to elevated unemployment is the traditional channel through which recessions reduce local government revenues. However, lockdowns and social distancing measures sharply decreased household consumption from which governments derive substantial revenue. As detailed in Section 2, states that rely strongly on sales tax have seen their revenue plummet.

While the CPS data allows us to distinguish between state government and local government workers, we cannot observe which local government employs a given municipal worker. Therefore, we aggregate state and local government workers together within a state and assemble a measure of sales tax revenue dependence that aggregates across all levels of government within a state. We assemble this measure using annual revenue data from 2017, the most recently available from the Census of Governments.

Table 1
Summary Statistics

	Average	σ (cross-section)	Min	25th pct.	75th pct.	Max
	State and Local Governments					
State and Local Governments Finances						
Total Revenues (billions)	78.1	104.0	8.2	21.4	91.6	615.8
Sales Tax (share of total revenue %)	14.7	5.03	3.62	12.4	16.7	27.4
State and Local Gov. Employment						
ΔMuni Laid Off (April)	8.69	4.69	0.227	5.5	10.9	20.2
ΔMuni Laid Off (May)	6.45	4.24	−0.023	3.97	8.24	23.8
ΔMuni Laid Off (June)	5.57	3.44	−1.43	3.56	6.47	15.8
ΔMuni Laid Off: Healthcare (April)	5.92	13.6	0	0	5.97	63.3
ΔMuni Part Time (April)	13.8	9.15	−10.4	9.73	19.7	34.4
ΔMuni U/R (April)	8.55	5.11	−4.29	5.79	12.5	18.4
CARES Act						
CRF funds (share of revenue %)	5.29	3.18	1.99	3.36	5.88	15.2
	State Governments					
State Government Finances						
Total Revenues (billions)	50.6	63.8	6.0	16.0	60.0	392.9
Sales Tax (share of total revenue %)	17.7	6.5	2.49	14.2	20.3	31.9
Rainy Day Funds (share of expenditure %)	10.1	14.4	0	4.58	10.9	96.6
State Gov. Employment						
ΔState Laid Off (April)	7.15	5.4	0	3.86	8.66	24.7
ΔState Laid Off (May)	4.96	5.78	−0.309	1.28	7.13	32.3
ΔState Laid Off (June)	3.61	4.07	−3.44	0	5.56	19.2
ΔMuni Laid Off: Healthcare (April)	5.92	13.6	0	0	5.97	63.3
CARES Act						
CRF funds (fraction of revenue %)	7.59	4.23	3.52	4.91	7.84	20.9
	Federal Government					
State Gov. Employment						
ΔFederal Laid Off	3.78	5.42	−3.05	0	5.87	21.8

This table reports summary statistics for the sample and variables used in the regression analysis in Section 3. Details of the variable and sample construction are described in the Online Data Appendix.

We consider employment response to this proxy for revenue shortfalls in the following specification:

$$\Delta l_i = \alpha + \beta SalesTaxShare_i + \gamma X_i + \varepsilon_i,$$

where the dependent variable Δl_i represents the change in public sector employment in state i, the independent variable $SalesTaxShare_i$ is the share of state and local revenues in state i derived from sales taxes, and X is a set of control variables. We consider several measures of the change in public sector employment based on the level or change in the unemployment rate among state and local government workers in a state. Table 1 describes the variables used in the regression analysis.

There are difficulties associated with measuring unemployment during the coronavirus crisis. Some of the questions asked in the CPS survey are ambiguous regarding why a respondent is not at work, chiefly whether the respondent is staying at home because of economic conditions, or staying at home for health reasons. In the COVID-19 pandemic these are overlapping, and there may be misreporting. We consider different measures to draw a full picture of unemployment in the first months of 2020. Our main measure is the ratio of workers in an industry state pair who indicate they were absent from work because they were laid off to the total size of the labor force in that industry state pair.

We begin by examining the unconditional relationship between our measure of public sector unemployment and the share of revenue coming from sales tax. Figure A3 plots the April 2020 unemployment rate of state and local government workers against the aggregate sales tax share of revenue of governments in that state, and shows a clear positive relationship between sales tax dependence and public worker layoffs.

Multivariate regression analysis of this relationship is presented in Table 2. The first column includes no control variables. The coefficient of 0.42 on $SalesTaxShare$ indicates that a state with a one percentage point higher share of revenue coming from sales taxes had a 0.42 percentage point higher unemployment rate in April 2020 among public employees. Quantitatively, the standard deviation of the sales tax share in the cross-section of states is 5%; thus a one standard deviation increase in the sales tax share translates into a 2.1 percentage point higher unemployment rate for public employees in April 2020, from a base rate of 1.2% in February 2020.

The second column adds covariates that capture other likely determinants of local government unemployment—population size, the severity of the pandemic, and the private sector unemployment rate in the state. States with a higher COVID-19 death rate relative to infection rate laid off more public workers and the conditional elasticity of public sector layoffs to private sector layoffs is 0.14. Including these controls lowers the magnitude of the

Table 2

Short Run Unemployment Response of State and Local Governments: April 2020

	(1) Δ Muni Laid Off	(2) Δ Muni Laid Off	(3) Δ Muni Healthcare Laid Off	(4) Δ Muni Laid Off	(5) Δ Muni Laid Off	(6) Δ Muni Laid Off
Sales Tax Exposure	0.42***	0.26**	−0.093	0.29**	0.26*	0.21*
	(4.24)	(2.39)	(−0.50)	(2.59)	(1.78)	(1.82)
Property Tax Exposure				0.011	−0.027	−0.036
				(0.093)	(−0.24)	(−0.37)
Intergov Exposure				−0.0083	0.015	0.067
				(−0.050)	(0.086)	(0.41)
Income Tax Exposure				0.063	0.10	0.092
				(0.48)	(0.80)	(0.94)
COVID Infection Rate		−0.048**	−0.048	−0.051**	−0.0085	−0.0011
		(−2.28)	(−1.21)	(−2.19)	(−1.23)	(−0.31)
COVID Death Rate		2.19**	0.99	2.27**	0.15	0.019
		(2.34)	(0.58)	(2.24)	(1.11)	(0.38)
Log Population		0.014**	0.020	0.013*	0.00060	0.0068
		(2.45)	(1.40)	(1.93)	(0.11)	(1.33)
Δ Private Laid Off		0.14	−0.13	0.13	0.051	0.11
		(1.55)	(−0.78)	(1.51)	(0.47)	(0.76)
Constant	0.026*	−0.18**	−0.21	−0.17	0.0064	−0.10
	(1.70)	(−2.23)	(−0.99)	(−1.51)	(0.060)	(−0.96)
Date	*April*	*April*	*April*	*April*	*May*	*June*
N	50	50	50	50	50	50
r2	0.20	0.38	0.030	0.38	0.16	0.22

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table reports analysis of the change from February to April 2020 in the fraction of state and local government workers who have laid off. The *Sales Tax Dependence* coefficients measure the conditional relationship between the sales tax revenue exposure of governments in a state and the change in the unemployment rate of state and local government workers. Column 2 controls for the COVID-19 infection and death rates in a state as of April 2020, state population, and the change in the layoff rate of private sector workers in the state. Column 3 replaces the dependent variable with the change in the fraction of laid off workers among those classified as healthcare workers in the CPS data. Column 4 adds measures of dependence on other major sources of government tax revenue. t-statistics for heteroskedasticity-robust standard errors are reported in parenthesis.

sensitivity of layoffs to sales tax revenue exposure to 0.26, though it remains strongly statistically significant. The third column shows that while state and local governments with high sales tax exposure cut employment, they did not cut employment among public employees with healthcare occupations. In the fourth column, we include other major sources of government revenue, property taxes, income taxes, and intergovernmental transfers, and find none of these explain public worker layoffs conditional on sales tax dependence. These estimates explain a significant fraction of observed state and local government layoffs. These coefficient estimates can be used to generate estimates of the aggregate number of job losses attributable to fiscal stress caused by sales tax revenue declines. Multiplying the coefficient estimate of 0.29 in Column 4 by a state's sales tax share of revenue generates the predicted increase in layoffs attributable to sales tax revenue declines. Multiplying this by the February 2020 level of public employment in the state and summing over all states, this explains over 660,000 of the more than one million observed state and local job losses in April 2020.

Appendix Table A3 explores the robustness of this relationship. The first column of Table A3 reproduces column 3 of Table 2. The second column reports the same specification with the standard measure of unemployment rate. The third column replaces the dependent variable with a measure of what fraction of public sector workers reported being moved from full-time to part-time hours. The coefficient estimate suggests exposed governments cut the hours of more employees than they laid off. The fourth column reports a placebo specification with data from January 2020 instead of April 2020. We find no relationship between a state's sales tax share of revenue and the two-month change in public sector layoffs to January 2020, before the risk of the pandemic was apparent. In the fifth column we report another placebo specification that looks at layoffs of federal government workers across states and find this is also not related to our proxy for revenue exposure to the pandemic.

3.2 CARES Act Funding for State and Local Governments

We also explore the relationship between public sector layoffs and funding to state and local governments provided by the CARES Act. The CARES Act allocated $150 billion dollars to state and local governments through the Coronavirus Relief Fund. The amount allocated to each state was proportional to the population of the state, subject to the constraint that no one state received less than $1.25 billion dollars from the program. Figure A4 shows the funding distributed to states as a function of their population.

Twenty-one states received the minimum $1.25 billion in funding. Among these states, variation in state population translates directly into variation in the amount of funding received per capita. Assuming state and local government spending per capita is not related to population with the same functional form as seen in Figure A4 this variation can be

exploited to estimate the causal effect of the federal grants on the layoffs of state and local governments employees.

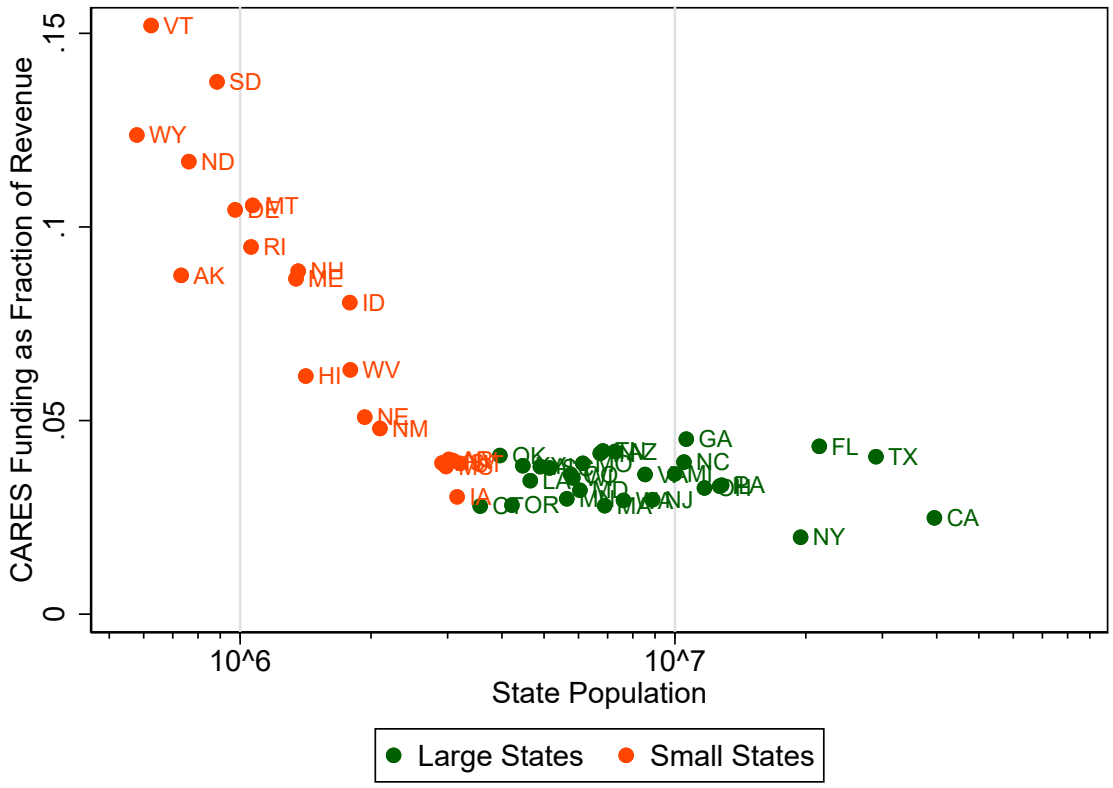


Figure 1.
CARES Funding Exposure and State Population.
Figure 1 plots the CARES Act funding received by a state as a fraction of state and local government revenues in that state against state population, as measured from 2019 Census estimates. Small states, pictured in orange, received identical awards of $1.25 billion while larger states, pictured in green, recieved awards proportional in size to their population. Population is on a log scale.

Figure 1 shows that for states receiving the minimum level of federal aid, the funding as a fraction of total state and local government revenues is strongly negatively correlated with state population. Vermont's $1.25 billion of aid is roughly 15 percent of total state and local government revenues, while in New Mexico this figure is less than five percent. For the large states, which received CARES act funding proportional to population, federal aid as a fraction of total revenues is roughly constant.

Table 3
State and Local Government Layoffs and CARES Act Receipts

	(1) OLS Below	(2) FS	(3) IV	(4) IV (Health)	(5) IV	(6) IV (May)	(7) IV (June)
CARES Act Exposure	-0.63^{***}		-0.69^{***}	-0.94^{**}		-0.35^{**}	-0.45^{***}
	(-3.17)		(-3.93)	(-2.33)		(-2.09)	(-4.45)
Low Rainy Day # CARES Act Exposure					-0.95^{***}		
					(-2.63)		
Med Rainy Day # CARES Act Exposure					-1.05^{***}		
					(-2.91)		
High Rainy Day # CARES Act Exposure					-0.60^{***}		
					(-2.88)		
Sales Tax Exposure							
Small State		-0.018^{**}					
		(-2.63)					
$Population^{-1}$ × Small State		74534.9^{***}					
		(7.48)					
$Population^{-1}$ × Large State		-10727.6					
		(-0.51)					
COVID Infection Rate	-0.054^{**}	-0.0074^{*}	-0.055^{***}	-0.066	-0.054^{***}	-0.070^{**}	-0.051^{***}
	(-2.56)	(-1.82)	(-2.76)	(-1.52)	(-2.64)	(-2.03)	(-3.98)
COVID Death Rate	2.60^{***}	0.15	2.62^{***}	1.69	2.51^{***}	3.36^{*}	2.50^{***}
	(2.88)	(0.79)	(3.05)	(1.02)	(2.80)	(1.94)	(3.89)
N	50	50	50	50	50	50	50
r2	0.26	0.89	0.26	0.036	0.29	0.20	0.30
F	5.29	36.2	6.72	1.74	3.55	2.01	10.7

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table reports analysis of the relationship between changes in state and local government employment and the amount of CARES Act funding received by a state. *CARES Act Dependence* is defined as the amount of money the state received from the CARES Act relative to the total state and local government revenue in that state in 2018. The first column reports ordinary least squares (OLS) regression results. The second column reports the first stage of instrumenting for *CARES Act Dependence* with an indicator for if a state received funding proportional to population (*Large State*) interacted with the inverse population of the state. Small states received a fixed dollar amount of funding and state population is strongly inversely proportional to *CARES Act Dependence*. Column 3 reports the specification instrumenting for *CARES Act Dependence* as described above. Column 4 replaces the dependent variable with the change in the fraction of laid off workers among those classified as healthcare workers in the CPS data. Column 5 instruments for CARES Act Dependence by rainy day fund terciles. Column 6 adds *Sales Tax Dependence* as an independent variable in the instrumental variables regression.

We exploit this fact to construct an instrument for the size of the grant received in each state. Specifically, if state revenue collections per capita are roughly constant, then for small states the CRF award as a fraction of total revenue is proportional to the inverse population of the state. For large states receiving funding proportional to their population, the CRF funding as a fraction of total revenue is constant. Thus we instrument for CRF funding as a fraction of state and local government revenue with the interaction of an indicator for states receiving the minimum CRF award and the inverse of the state's population.

We find that federal aid received through the CRF limited government employee layoffs in April of 2020. Table 3 reports the results of the regression analysis. Column 1 shows the ordinary least squares relationship between CRF funding as a share of state and local revenues and layoffs. Column 2 reports the first stage relationship between CARES funding and inverse population, which is highly significant with an F-statistic of 36.2 and an R^2 of 89.2%. Column 3, 4, and 5 report the instrumental variables specification. A state that received larger federal aid by ten percent of annual revenues laid off 6.9 percentage points fewer state and local government employees.

This estimate can be used to estimate a "payroll multiplier" for the Coronavirus Relief Fund. Our estimates imply aggregate jobs saved by federal funding can be estimated as:

$$N_{saved} = -\sum_{s} \hat{\beta} \times \frac{CARES_s}{Revenue_s} \times L_{0s}$$

where N_{saved} is the total number of jobs saved by CARES funding and L_{0s} is the ex-ante number of local government employees in state s. Using the coefficient of 0.69 we find the CARES Act funding supported approximately 441,000 jobs. According to March 2020 BLS estimates[5], the average compensation cost of state and local government employees including benefits was $52.45 per hour. Assuming a 2,000 hour work year this implies the average annual cost of a municipal worker is $104,900. The aggregate amount of funding distributed to states was $150 billion, implying each dollar of federal funding supported 31 cents of annual state and local payrolls.

The 31 cent payroll multiplier derived above should be interpreted with two important caveats. First, the calculation assumes the federal funding will cause, relative to a counterfactual with no CRF funding, state and local governments to maintain these 441,000 additional jobs for a full year. This assumption is likely overstating the true multiplier– the CRF funding was authorized only to cover expenses incurred in the final ten months of 2020. Further, Appendix Table A4 shows the magnitude of the relationship between CARES funding and employment declines from April to June. Second, the variation used

[5]See the Employer Costs for Employee Compensation News Release from the Bureau of Labor Statistics of March 2020 (https://www.bls.gov/news.release/ecec.htm, last accessed August 14th 2020).

to estimate the relationship between federal funding and state and local employment is entirely coming from small states that received relatively large amounts of federal funding. It is possible that larger states receiving proportionally less funding had greater need for marginal federal dollars and may have used it to support more employment.

The CRF stipulated that funding could only be used for unplanned expenses related to COVID-19. Despite the limitation on use of CRF funds, these results indicate it was used to support broad employment of state and local workers. To further explore if CRF funds were allocated as directed, we measure layoffs among public sector workers classified in the CPS as having a healthcare occupation. Column 4 of Table 3 shows the employment response to CRF funding was larger for public workers in healthcare than for public workers overall. This is somewhat surprising. Given that the results of Table 2 suggest state and local governments facing large sales tax revenue declines did not cut healthcare jobs, how did the CRF funding save *any* public healthcare jobs? These findings are consistent if there is another force that caused governments to lay off healthcare workers, but those receiving higher levels of CRF funding were able to use the funding to avoid such layoffs. The fact that we can identify a response for healthcare workers at all also suggests that for the large states (receving the lowest amount of funding per capita from the CRF), higher levels of federal aid would have been allocated toward more public health spending.

3.3 Rainy Day Funds

These results together suggest that state and local governments that have significant exogenous shocks to their revenues laid off and reduced the hours of significantly more employees immediately following the broad lockdown that started in March 2020. Whether this is evidence of the binding balanced budget constraint of these governments depends on if these governments viewed their revenue exposure as transitory. A persistent decline in expected revenues could cause governments to quickly reduce spending even in the absence of a binding financing constraint.

To explore this possibility, we look at how sales tax dependence and the size of a state's rainy day fund affect their employment response. As described in Section 2.2, states maintain rainy day funds to ensure they can balance the budget in the event of unanticipated changes in revenues or expenditures that realize over the fiscal year. We only have data available for such rainy day funds for state governments, so we now focus on state government workers. Table 4 explores the ability of rainy day funds, as a fraction of 2020 budgeted state expenditures, to explain the cross-section of state employee layoffs. Alaska and Wyoming are significant outliers in rainy day fund balances at over 50% and 100% of annual expenditure, respectively, and are excluded from the analysis. Column 1 shows that the size of these reserve balances is a strong predictor of layoffs in April 2020. A rainy day

Table 4
State Government Layoffs and Rainy Day Fund Balances

	(1) Δ State Laid Off	(2) Δ State Health Laid Off	(3) Δ State Laid Off	(4) Δ State Laid Off	(5) Δ State Laid Off	(6) Δ State Laid Off
Rainy Day Fund Exposure	−0.31**	0.17	−0.30**		−0.32**	−0.10
	(−2.40)	(0.64)	(−2.43)		(−2.53)	(−1.11)
Sales Tax Exposure			0.20			
			(1.64)			
Low Rainy # Sales Tax Exp.				0.33*		
				(1.69)		
Med Rainy # Sales Tax Exp.				0.18		
				(1.51)		
High Rainy # Sales Tax Exp.				0.12		
				(0.99)		
Date	*April*	*April*	*April*	*April*	*May*	*June*
N	48	48	48	48	48	48
r2	0.24	0.014	0.29	0.29	0.23	0.065

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table reports analysis of the employment dynamics of state government workers from February to April 2020. *Rainy Day Fund Exposure* denotes the size of a state's rainy day fund for FY2020 as a fraction of expenditures. The dependent variable is the same as defined in Table 2 except using only state government employees instead of state and local government employees in a state. Column 2 looks at only state employees classified in the CPS as healthcare workers. Column 5 uses as the dependent variable changes in layoffs from February to May 2020. The dependent variable in column 6 is the change in layoffs from February to June 2020. *Low, Med,* and *High Rainy* are indicators for terciles of rainy day funds as a fraction of annual state expenditures. All specifications control for *COVID Infection Rate*, *COVID Death Rate*, and log state population. All variables are defined as in Table 2.

fund larger by 10 percentage points of general fund expenditure is associated with a 2.9 percentage point lower change in the unemployment rate of state workers from February to April 2020. The second column shows this channel is independent of the effect of a state's dependence on sales tax revenue. The third column reports the employment sensitivity of states to revenue exposure by tercile of rainy day fund size as a percent of budgeted expenditure. Sensitivity to revenue exposure is highest among states with the lowest rainy day fund balances. This is consistent with the idea that states rainy day balances are a form of precautionary savings used to hedge against the inability to smooth revenue shocks with borrowing. States with higher rainy day fund balances effectively had a less binding financial constraint and were better able to smooth their spending.

Last we also examine the response of state employment to the CARES Act through the lens of balanced budget rules and states' reserve capacity. In column 4 of Table 3, we find that the states in the two lowest terciles of rainy day funds present an elasticity of employment to the CARES Act close to unity (0.95 and 1.05 for the lowest and second lowest tercile respectively). States with larger reserves, in the highest tercile, have an elasticity of 0.6, 40% smaller. As we emphasize in Section 3.2, a unit elasticity corresponds to a an allocation of funds that is identical to the existing budget. States with higher reserves, i.e. with lower budget constraints, allocate funds from the CARES Act in a different way than their general budget. The 0.6 elasticity of employment to CARES funding suggests that unconstrained states are able to allocate the funds to other crucial budget lines such as health care services, and social nets programs.[6]

3.4 Longer Run Response

We also study determinants of public sector layoffs as measured in the May and June 2020 CPS surveys. In regression specifications these are expressed as a difference in the rate of workers reporting a layoff measured in May or June relative to the same measure in February. The final two columns of Tables 2, 3, and 4 report the relationship between layoffs in May and June and sales tax dependence, CRF funding, and rainy day fund balances, respectively. The relationship between fiscal capacity and layoffs is fairly persistent across these measures through June, though the magnitude of the relationship declines somewhat over time. A noteable exception is that the relationship between rainy day fund levels and state worker layoffs disappears entirely in June.

[6]For the month of May of 2020, the State of California increased spending for Health and Human Services by 48 million dollars (a 470% increase), and their social services spending which include supplemental security income and other cash assistance programs, by 390 million dollars (a 180% increase). See the Statement of General Fund Cash Receipts and Disbursements of the California State Controller (https://sco.ca.gov/Files-ARD/CASH/May2020StatementofGeneralFundCashReceiptsandDisbursements.pdf ; last accessed July 14th 2020). California has the fourth largest rainy day fund of all states as a fraction of government expenditures.

4 Conclusion

By the first week of April 2020, 40 states had enacted various forms of shelter-in-place policies and announced closing of non-essential businesses (see Figure 2.2 for a time-line of state policy with the evolution of the impact of Covid-19 in the U.S.). These policies had large impacts on local economies and on local government budgets. Our findings link the immediate fiscal impact of the pandemic to employment reductions at state and local governments. The pattern of employment contraction among these governments points to binding balanced budget constraints as an explanation of this relationship. The inability of state and local governments to conduct significant deficit spending prevented them from borrowing to smooth the sharp declines in revenue and increases in expenditure brought by the pandemic. Governments that depend more on sales tax revenue saw sharper declines in employment than others. Replacement revenue was also valuable. States that received exogenously more federal funding from the 2020 CARES Act were able to preserve more public sector jobs. The size of a state's rainy day fund also predicted job cuts. Particularly suggestive of a role for binding balanced budget constraints, the relationship between sales tax dependence and employment declines was strongest in states with the smallest rainy day fund balances.

While both households and corporations benefited from Federal fiscal policy early in the pandemic, state and local governments have raised concerns that they offer significantly more support than they have received. For households which were largely affected by a large rise in unemployment, fiscal policy responded to the magnitude of the shock providing unemployment insurance extension, mortgage forbearance, in the goal of dampening the shock of a stopped economy. No such stabilizer ensures that state and local governments, which are responsible for nearly half of total public expenditure, are able to continue providing essential public services when their revenues decline sharply. Subject to balanced budget requirements and without such funding measures, our evidence shows that local government service provision is in fact significantly procyclical.

References

Alt, James E. and Robert C. Lowry, "Divided Government, Fiscal Institutions, and Budget Deficits: Evidence from the States," *American Political Science Review*, 1994, *88* (4), 811–828.

Baicker, Katherine, Jeffrey Clemens, and Monica Singhal, "The rise of the states: U.S. fiscal decentralization in the postwar period," *Journal of Public Economics*, 2012, *96* (11), 1079 – 1091. Fiscal Federalism.

Cajner, Tomaz, Leland D Crane, Ryan A Decker, John Grigsby, Adrian Hamins-Puertolas, Erik Hurst, Christopher Kurz, and Ahu Yildirmaz, "The U.S. Labor Market during the Beginning of the Pandemic Recession," Working Paper 27159, National Bureau of Economic Research May 2020.

Chodorow-Reich, Gabriel, "Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned?," *American Economic Journal: Economic Policy*, May 2019, *11* (2), 1–34.

_ , Laura Feiveson, Zachary Liscow, and William Gui Woolston, "Does State Fiscal Relief during Recessions Increase Employment? Evidence from the American Recovery and Reinvestment Act," *American Economic Journal: Economic Policy*, April 2012, *4* (3), 118–45.

Clemens, Jeffrey and Stephen Miran, "Fiscal Policy Multipliers on Subnational Government Spending," *American Economic Journal: Economic Policy*, May 2012, *4* (2), 46–68.

Erel, Isil and Jack Liebersohn, "FinTech Substitute for Banks? Evidence from the Paycheck Protection Program," Working Paper 2020-03-016, The Ohio State University 2020.

Fairlie, Robert W, Kenneth Couch, and Huanan Xu, "The Impacts of COVID-19 on Minority Unemployment: First Evidence from April 2020 CPS Microdata," Working Paper 27246, National Bureau of Economic Research May 2020.

Fatás, Antonio and Ilian Mihov, "The macroeconomic effects of fiscal rules in the US states," *Journal of Public Economics*, 2006, *90* (1), 101 – 117.

Flood, Sarah, Miriam King, Renae Rodgers, Steven Ruggles, and J. Robert Warren, "Integrated Public Use Microdata Series, Current Population Survey: Version 7.0 [dataset]," Minneapolis, MN: IPUMS 2020.

Granja, João, Christos Makridis, Constantine Yannelis, and Eric Zwick, "Did the Paycheck Protection Program Hit the Target?," Working Paper 27095, National Bureau of Economic Research May 2020.

Hou, Yilin and Daniel L. Smith, "Do State Balanced Budget Requirements Matter? Testing Two Explanatory Frameworks," *Public Choice*, 2010, *145* (1), 57–79.

Kahn, Lisa B, Fabian Lange, and David G Wiczer, "Labor Demand in the Time of COVID-19: Evidence from Vacancy Postings and UI Claims," Working Paper 27061, National Bureau of Economic Research April 2020.

National Conference of State Legislatures, "State Balanced Budget Provisions," Technical Report, NCSL, Washington D.C. 2010.

Poterba, James M., "State Responses to Fiscal Crises: The Effects of Budgetary Institutions and Politics," *Journal of Political Economy*, 1994, *102* (4), 799–821.

_ , "Balanced Budget Rules and Fiscal Policy: Evidence from the States," *National Tax Journal*, 1995, *48* (3), 329–336.

_ , "Capital budgets, borrowing rules, and state capital spending," *Journal of Public Economics*, 1995, *56* (2), 165 – 187.

Raifman, J., Nocka K., Jones D., Bor J., Lipson S., Jay J., and Chan P., "COVID-19 US state policy database.," Boston, MA: BU 2020.

Shoag, Daniel, "Using State Pension Shocks to Estimate Fiscal Multipliers since the Great Recession," *American Economic Review*, May 2013, *103* (3), 121–24.

_ , Cody Tuttle, and Stan Veuger, "Rules versus Home Rule: Local Government Responses to Negative Revenue Shocks," Working Paper 2017-15 August 2017.

Suárez Serrato, Juan Carlos and Philippe Wingender, "Estimating Local Fiscal Multipliers," Working Paper 22425, National Bureau of Economic Research July 2016.

Wilson, Daniel J., "Fiscal Spending Jobs Multipliers: Evidence from the 2009 American Recovery and Reinvestment Act," *American Economic Journal: Economic Policy*, April 2012, *4* (3), 251–82.

Online Appendix

Data Appendix

The main sample for the analysis in this paper comprises cross-sectional data about state and local governments for the 50 US States. We combine data from several sources on fiscal, employment, and demographic information at state and local levels.

As described in Section 2, we use the Annaul Surveys of State and Local Government Finances from the Census of Governments to measure the fraction of revenues of state and local governments coming from different sources.[7] The ASSLGF files provide detailed estimates of expenditure and revenue for governments at the state and local levels, aggregated by state, from 1967 to 2017. These estimates are based on surveys of state and local governments that occur with differing frequencies and sampling rates depending on the level of government (state, county, city and township, etc.). For years ending in 2 and 7 the survey is comprehensive, for other years annual numbers are imputed from selective sampling. We use the 2017 data to create measures of state and local government exposure to different revenue sources for the regression analysis . *Sales Tax Exposure* is defined as the ratio of revenue from Sales and Gross Receipts to total Total Revenue. *Income Tax Exposure* combines personal and corporate income taxes. *Intergov Exposure* is defined as the revenue received from higher levels of government (federal government for states, and federal and state for local governments) as a share of total revenues. When we combine state and local governments into a single measure, intergovernmental revenues from the state are netted out.

We measure employment using the Bureau of Labor Statistic's Current Population Survey (CPS) public use microdata. The data is retrieved from the IPUMS CPS archive at cps.ipums.org. We use the Basic Monthly samples from January to June 2020. All microdata is aggregated using the Final Basic Weights (*wtfinl*) by state, month, worker class (private, federal government, state government, local government to estimate labor force characteristics of each cell. Specifically, we measure the size of the labor force, the number of people employed, number unemployed, and the number who indicate they are laid off. At this level of granularity the number of survey respondents in each cell can be small, and thus the estimates of population levels, and month to month changes in levels can be noisy. To reduce the impact of measurement error we instead focus on ratios. Specifically, we compute the estimated *fraction* of workers who are laid off as the estimated number of workers laid off in a cell divided by the estimated size of the labor force in that cell. Our main variable of interest, Δ *Muni Laid Off* , is the change from February 2020 in the fraction of state and local government workers in a cell classified as laid off. We also compute the change from February in the more standard unemployment rate (employed divided by employed plus unemployed). For most specifications we use respondents of all occupations. We also study employment of healthcare workers specifically, which corresponds to CPS 2020 Occupation codes 3000 through 3655.

[7] As of August 14, 2020, documentation for the ASSLGF is available here: https://www.census.gov/programs-surveys/gov-finances.html. An archive of the data and documentation is available from the authors upon request, as the Census website is notoriously unreliable.

Effect of Tax Decrease on Public Employment

While the events unfolding in the Spring of 2020 are remarkable, the response of states to a loss in revenue is not (see Poterba (1994)). We extend our analysis of the impact from local government finances to local public employment to the period spanning 1992 to 2018. Expanding the sample sheds light on how specific the Spring 2020 moment is, as we compare the magnitudes of our estimates. Moreover we find that the effect of a loss of tax revenues to employment is persistent, suggesting a long-lasting impact of the COVID-19 crisis on local governments.

To analyze state and local governments in the long run, we link both the financial files (ASSGF) and the payroll files (ASPEP) from the Census of Governments. In Table A5 we consider the effect of tax revenues on state and local governments employment. In column 1, we find that local private employment correlates positively with state and local tax revenues combined; a loss in revenue of 10% corresponds to a decrease of 1% in private employment, confirming the procyclical nature of local tax revenues. In columns 2, 3, and 5, we examine separately the effect of a local change in tax revenues on local employment — for both state and local first, then state only, and finally for local governments only. We find a negative effect of tax revenues on unemployment, echoing the results documented above for the Spring of 2020 in Tables 2 and A3. A 10% decline in local tax receipts correlates with a 1.4% decrease in local government employment, and a 10% decline in states' tax receipts correlates with a 0.8% decline in state employment.

In column four, we zoom-in on state governments to investigate the role of balanced budget requirements, and the ability of local governments to run counter-cyclical fiscal policy. As described in Section 3.3 and in Table 4, we examine the role of rainy day funds in the larger sample. We form terciles at the state level for the level of rainy day funds as a fraction of total expenditures; we find that for states with low levels of savings the elasticity of state employment to tax revenues is 15% larger than for states with sufficient savings (in the highest tercile). This result highlights the role played by the institutional rules imposing balanced budget for state governments, and highlights how constrained states have more cyclical public employment.

Last we go beyond the contemporaneous cross-sectional relations to evaluate the persistence of the effect of tax revenues on employment. In Table A6, we show how the effect of state and local government tax revenues on employment persist up to three years, suggesting that tax revenues play a role on public employment beyond their contemporaneous impact.

Appendix Figures and Tables

Figure A1.

Timeline of the Impact of Covid-19 in the U.S. and the Response of States.

This figure represents the timeline of the impact of the Coronavirus across U.S. States. Panel A and B represent the number of new deaths and new cases across the U.S. from the Covid tracking project. Panel C represents the number of U.S. States adopting policies in response to the coronavirus crisis: state of emergency, stay-at-home or shelter-at-home recommendations or a closing of businesses with data from Raifman et al. (2020).

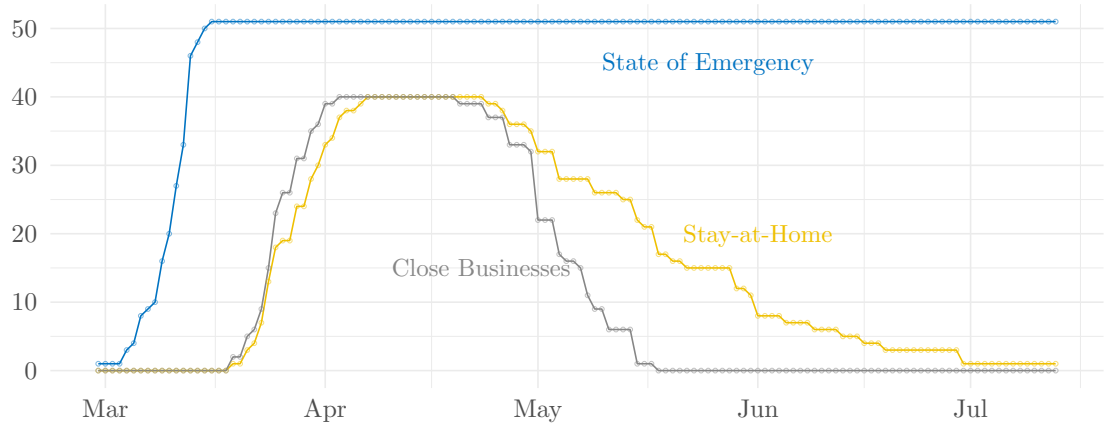


Figure A2.

Rainy Day Funds across States in 2018.

Figure A2 represents the state of rainy day funds in 2018 as a fraction of total general expenditures (Panel A) and as a fraction of total payrolls (Panel B). Note the truncated axis for Wyoming and Alaska. The data is from the NASBO Fiscal Survey of the State for the year 2019 and from the Census of Governments 2018 ASPEP files for payrolls.

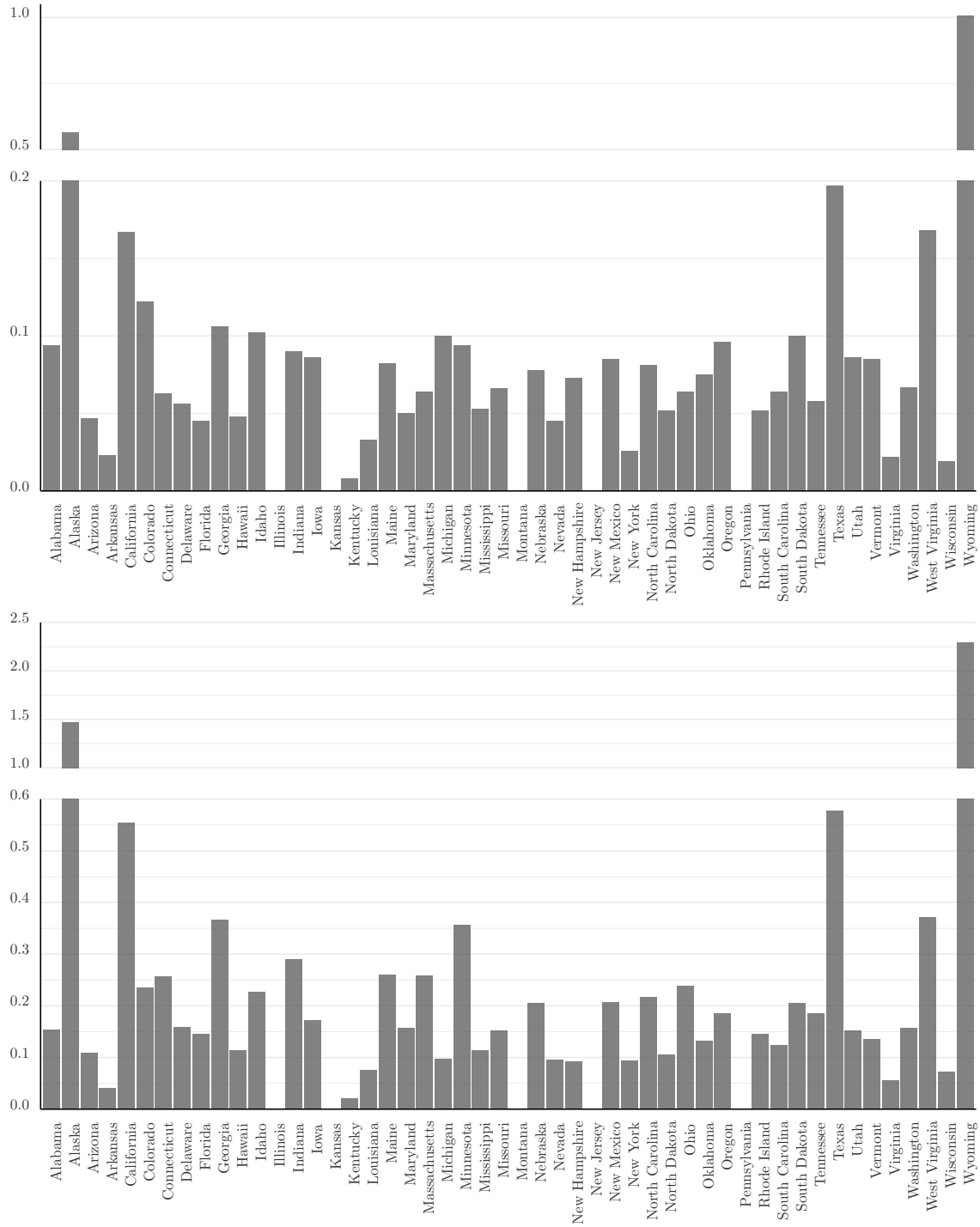


Figure A3.

Local Government Unemployment: April 2020

Figure A3 shows the relationship between state and local governments' *Sales Tax Dependence* and the unemployment rate of state and local government workers in that state in April 2020. *Sales Tax Dependence* is defined as the fraction of state and local government revenues derived from sales taxes. The April 2020 unemployment rate among state and local government workers in a state is measured from the April 2020 CPS Survey as the (sampling weighted) fraction of respondents working for state and local governments in a state indicating they had been laid off.

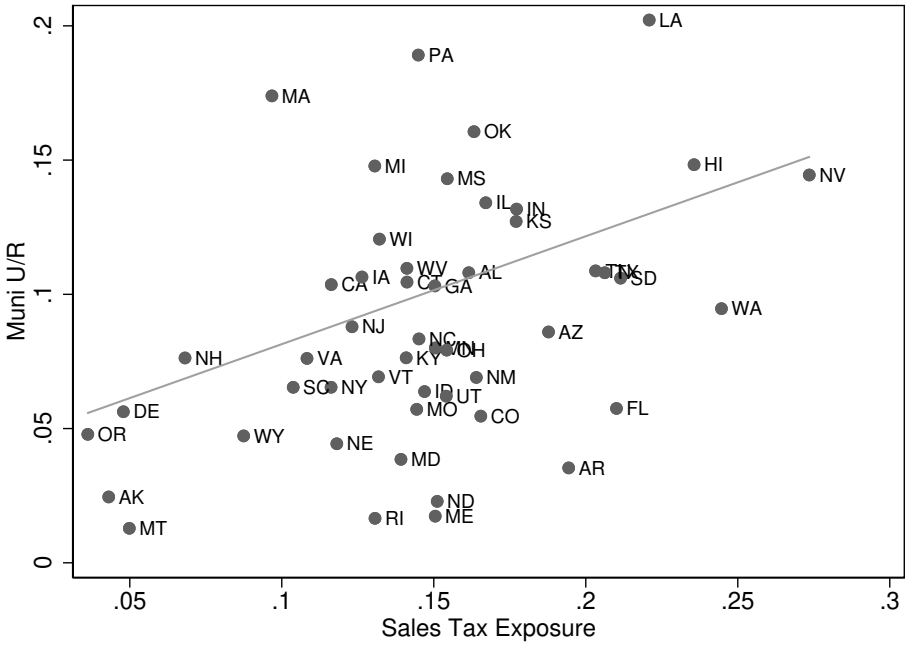


Figure A4.
CARES Funding and State Population.
Figure A4 plots the CARES Act funding received by a state against state population, as measured from 2019 Census estimates. Small states received identical awards of $1.25 billion, and larger states received funding proportional to their population. Population is on a log scale, causing the relationship to appear exponential.

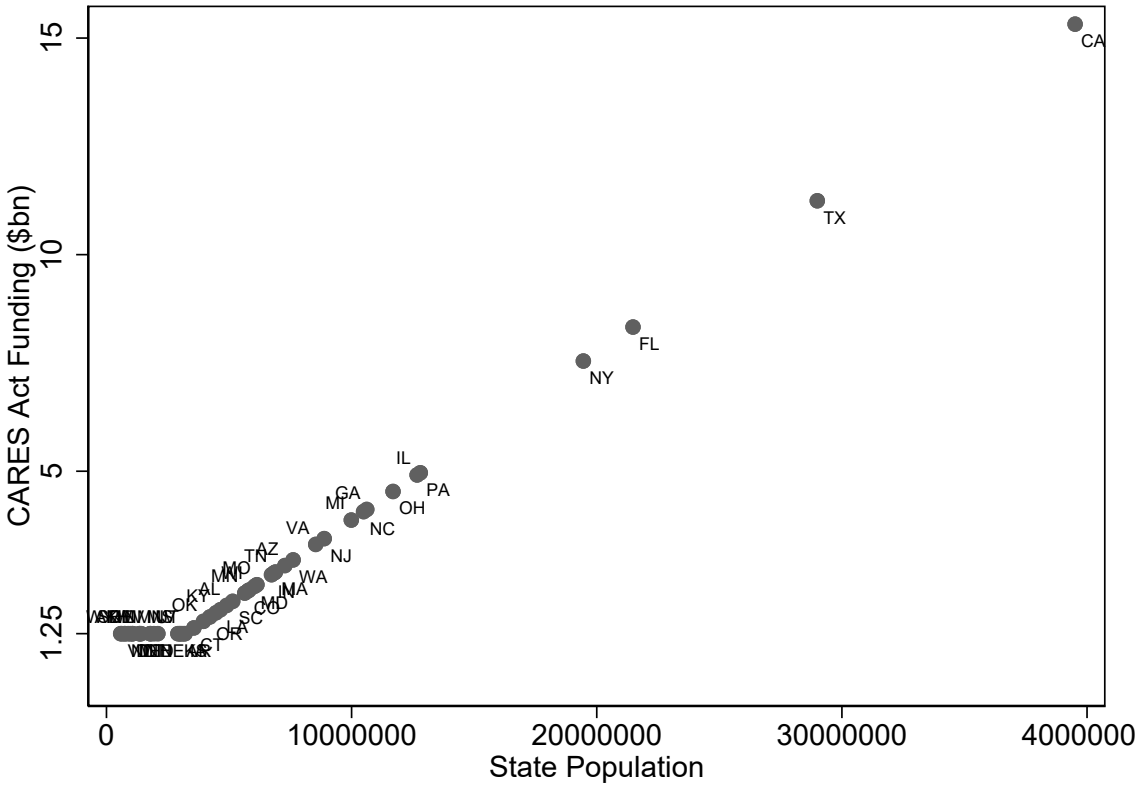


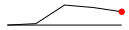
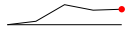
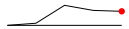
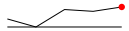
Table A1
Tax Revenues by Population across States

	Average	Min	25th pct.	75th pct.	Max
	Panel A. State Governments				
Total Tax Revenues					
$\sigma(\Delta\text{tax})$	0.084	0.034	0.068	0.092	0.199
Sales Tax					
$\sigma(\Delta\text{tax})$	0.06	0.028	0.045	0.071	0.14
Share of total rev.	0.252	0	0.192	0.283	0.597
Indiv. Income Tax					
$\sigma(\Delta\text{tax})$	0.087	0.045	0.065	0.094	0.229
Share of total rev.	0.219	0	0.185	0.294	0.434
Corp. Income Tax					
$\sigma(\Delta\text{tax})$	0.103	0.053	0.074	0.113	0.289
Share of total rev.	0.248	0	0.215	0.3	0.423
	Panel B. Local Governments				
Total Tax Revenues					
$\sigma(\Delta\text{tax})$	0.202	0.056	0.131	0.24	0.561
Property Tax					
$\sigma(\Delta\text{tax})$	0.203	0.067	0.127	0.251	0.546
Share of total rev.	0.634	0.215	0.452	0.849	0.983
Sales Tax					
$\sigma(\Delta\text{tax})$	0.237	0.037	0.126	0.265	0.991
Share of total rev.	0.16	0	0	0.269	0.641
	Panel C. State & Local Governments				
Total Tax Revenues					
$\sigma(\Delta\text{tax})$	0.071	0.044	0.062	0.075	0.135
Property Tax					
$\sigma(\Delta\text{tax})$	0.144	0.051	0.093	0.16	0.423
Share of total rev.	0.264	0.115	0.217	0.302	0.568
Sales Tax					
$\sigma(\Delta\text{tax})$	0.066	0.028	0.049	0.074	0.188
Share of total rev.	0.215	0	0.162	0.259	0.485
Indiv. Income Tax					
$\sigma(\Delta\text{tax})$	0.086	0.045	0.065	0.094	0.221
Share of total rev.	0.179	0	0.143	0.242	0.335
Corp. Income Tax					
$\sigma(\Delta\text{tax})$	0.101	0.051	0.076	0.108	0.261
Share of total rev.	0.188	0	0.156	0.236	0.301

The table reports summary statistics of tax revenues per capita for State and Local governments from 1980 to 2017. Panel A reports estimates for State governments. $\sigma(\Delta\text{tax})$ is the standard deviation of the year-on-year growth of taxes by categories across states. Estimates report the average, minimum, maximum, 25th and 75th percentile of the volatility of taxes across states and the same statistics of the average share of tax categories in total taxes. Panel B reports estimates for local governments (county, municipal and township governments). Statistics are the same as in Panel B. Panel C reports the same statistics for state and local government aggregated at the state level from the Census of Governments ASSLGF files.

Table A2

National Unemployment during the COVID-19 Crisis

	Feb.	Mar.	Apr.	May.	June.	
Private Sector Unemployment						
(in thousands of workers)	4,955	5,905	18,311	16,669	13,848	
(unemployment rate in %)	4.38	5.36	18	15.9	12.8	
State Government Unemployment						
(in thousands of workers)	78.5	172	625	475	501	
(unemployment rate in %)	1.09	2.5	8.77	6.69	7.34	
Local Government Unemployment						
(in thousands of workers)	132	245	1,204	933	883	
(unemployment rate in %)	1.27	2.42	12.6	9.52	9.83	
Federal Government Unemployment						
(in thousands of workers)	136	78.7	202	189	220	
(unemployment rate in %)	3.58	2.08	5.66	4.9	5.52	

We report the level of sectoral unemployment from Current Population Survey (CPS), for the four sectors of private, state, local and federal governments. Sectoral unemployment is defined as the number of individuals who are not currently employed and whose last primary job was in a given sector. The sectoral unemployment rate is the ratio of sectoral unemployment scaled by the total number of individuals whose current or last job was in a given sector. The last column summarizes the time series of employment in each sector.

Table A3

Short Run Unemployment Response of State and Local Governments: Robustness

	(1) Δ Muni Laid Off	(2) Δ Muni U/R	(3) Δ Part Time	(4) Δ Muni Laid Off	(5) Δ Federal Laid Off
Sales Tax Exposure	0.29**	0.37**	0.47*	−0.032	−0.16
	(2.59)	(2.66)	(1.83)	(−1.37)	(−0.86)
Property Tax Exposure	0.011	0.020	−0.14	−0.0031	0.073
	(0.093)	(0.13)	(−0.50)	(−0.10)	(0.27)
Intergov Exposure	−0.0083	0.011	0.033	−0.049	−0.070
	(−0.050)	(0.059)	(0.097)	(−1.12)	(−0.33)
Income Tax Exposure	0.063	0.12	0.20	0.0025	−0.32*
	(0.48)	(0.93)	(0.90)	(0.12)	(−1.86)
COVID Infection Rate	−0.051**	−0.045*	−0.074	−0.0021	−0.0022
	(−2.19)	(−1.99)	(−1.26)	(−0.43)	(−0.062)
COVID Death Rate	2.27**	1.82**	3.06	0.11	−0.38
	(2.24)	(2.06)	(1.26)	(0.52)	(−0.33)
Log Population	0.013*	0.018**	0.034**	−0.00063	−0.0032
	(1.93)	(2.65)	(2.68)	(−0.44)	(−0.37)
Δ Private Laid Off	0.13	0.13	−0.14	−0.39	0.30**
	(1.51)	(1.31)	(−0.76)	(−1.68)	(2.39)
Constant	−0.17	−0.27**	−0.44*	0.026	0.11
	(−1.51)	(−2.46)	(−2.01)	(1.03)	(0.70)
Date	*April*	*April*	*April*	*January*	*April*
N	50	50	50	50	50
r2	0.38	0.42	0.31	0.14	0.18

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table reports robustness analysis of the relationship between public sector employment and the revenue composition of state and local governments. Column 1 repeats the specification of Column 3 of Table 2. Column 2 replaces the dependent variable with the standard measure of the unemployment rate, the (sampling weighted) number of respondents in a geographic and sectoral category classified as unemployed relative to the total number of respondents in that category. Column 3 replaces the dependent variable with a measure of the change in workers moved from full to part time employment. Column 4 reports placebo results using as the dependent variable the change in the laid off fraction between November 2019 and January 2020. Column 5 reports placebo results using as the dependent variable the change from February to April 2020 in the laid off fraction of federal government workers in a given state. All variables are defined as in Table 2.

Table A4
Evolution of Local Government Unemployment Elasticities

	(1) Δ Muni Laid Off	(2) Δ State Laid Off	(3) Δ Muni Laid Off
April × Sales Tax Exposure	0.340**		
	(2.80)		
May × Sales Tax Exposure	0.219*		
	(2.35)		
June × Sales Tax Exposure	0.174		
	(1.51)		
April × Rainy Day Fund Exposure		-0.290*	
		(-2.30)	
May × Rainy Day Fund Exposure		-0.277*	
		(-2.41)	
June × Rainy Day Fund Exposure		-0.129	
		(-1.30)	
April × CARES Act Exposure			-0.598*
			(-2.12)
May × CARES Act Exposure			-0.195
			(-0.68)
June × CARES Act Exposure			-0.393*
			(-2.68)
N	150	144	150
r2	0.368	0.356	0.367

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table reports the relationship between state and local goverment worker layoffs and different measures of fiscal revenue sensitivity across April, May, and June 2020. Each regression is estimated as a Seemingly Unrelated Regression (SUR) specification stacking separate cross-sectional regressions across the three months. Each month has its own set of control variables. Column 1 reports the evolution of the relationship between layoffs and sales tax share of revenues. Column 2 uses the size of rainy day funds relative to annual expenditures as the independent variable, and column 3 uses the size of the states CARES act funding relative to its annual revenues.

Table A5

Employment and Local Government Tax Revenues

	(1) Private Emp.	(2) State and Local Emp.	(3) State Emp.	(4) State Emp.	(5) Local Emp.
log State and Local Tax Revenue	0.097**	0.073			
	(2.52)	(1.70)			
log State Tax Revenue			0.078***	0.068***	
			(3.82)	(3.89)	
log Local Tax Revenue					0.14*
					(2.05)
Low Rainy Day × log State Tax Revenue				0.0084**	
				(2.28)	
Med Rainy Day × log State Tax Revenue				0.0069	
				(1.35)	
Constant	6.24***	10.7***	9.65***	9.82***	9.29***
	(9.98)	(15.4)	(29.9)	(35.5)	(9.29)
N	1275	1275	1250	1091	1275
r2_within	0.011	0.0067	0.065	0.083	0.011

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table reports panel regression analysis of the relationship between public sector employment and state and local government tax revenues. The data is at the annual frequency by state, covering 1991 to 2017 (excluding 1995 due to data issues). Dependent variables are the natural log of the one-year-forward number of employment in the sector indicated in the column heading. The dependent variable in column 1 is the log number of private sector workers from the CPS. *State and Local Emp.*, *State Emp.*, and *Local Emp.* are log employment from the Annual Survey of Public Employment and Payroll (ASPEP). Terciles of rainy day fund balances are computed with respect to the full regression sample. Standard errors are clustered by state and year.

Table A6

Persistence of Employment and Local Government Tax Revenues

Future Employment Horizon:	(1) 1 year	(2) 2 year	(3) 3 year	(4) 4 year
	Private Employment			
S&L Tax Revenue	0.097**	0.079**	0.056	0.047
	(0.0385)	(0.0336)	(0.0389)	(0.0484)
	S&L Government Employment			
S&L Tax Revenue	0.073*	0.112***	0.068	0.007
	(0.0428)	(0.0391)	(0.0465)	(0.0694)
	State Government Employment			
State Tax Revenue	0.078***	0.068***	0.045***	0.016
	(0.0203)	(0.0173)	(0.0137)	(0.0103)
	Local Government Employment			
Local Tax Revenue	0.135**	0.120*	0.051	0.023
	(0.0663)	(0.069)	(0.0911)	(0.0718)

This table reports analysis of the relationship between log state and local government tax revenues and log public sector employment at various time horizons. Each reported coefficient is from a separate panel regression. The variables and sample are as defined in Table 4. Standard errors are clustered by state and year and are reported in parentheses.